



Individuals with high obsessive-compulsive tendencies or undermined confidence rely more on external proxies to access their internal states



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ABSTRACT

Background and Objectives: The Seeking Proxies for Internal States (SPIS) hypothesis predicts that obsessive-compulsive disorder (OCD) is associated with a deficit in subjective convictions, which may lead to a reliance on external substitutes for the perceptions of an individual's internal states. Two well-designed studies were performed for the present work that adopted a false bio-feedback procedure in a muscle tension task to examine the SPIS hypothesis.

Methods: The false bio-feedback paradigm was used to investigate our hypothesis. NeXus-10 Mark II hardware and V2011 BioTrace + software (Mind Media B.V., Herten, Netherlands) were utilized to measure the muscle tension of the flexor carpiulnaris muscle, which characterized the target's internal state. In addition, false EMG changes were recorded and displayed on a computer monitor and were considered external proxies.

Results: Study 1 demonstrated that the participants with high obsessive-compulsive (OC) tendencies were more affected by the false bio-feedback and exhibited lower confidence in their judgments regarding their muscle tension compared with the participants with low OC tendencies. These findings indicate that subjects with high OC tendencies were more influenced by self-perception effects. In contrast, the subjects in the undermined confidence group in Study 2 were more easily influenced by the false bio-feedback compared with the control group, which suggests that the subjects in the undermined confidence group were more affected by self-perception effects.

Limitations: We did not combine the undermined confidence with OC tendencies or OCD symptoms in our paradigm to investigate their joint effects on self-perception.

Conclusions: Our findings provide further evidence that supports the SPIS hypothesis, which indicates that OC tendencies and the confidence in an individual's recognition of internal states appear to have similar effects on the assessment of internal states and reliance on proxies.

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1. Introduction

Obsessive-compulsive disorder (OCD) is a highly recurrent and intractable neurosis with a lifetime prevalence of 2–3% in the general population (Linkovski, Kalanthroff, & Anholt, 2013). OCD is

a chronic and long-lasting disorder that is characterized as persistent and distressing intrusive thoughts, such as obsessions, which may cause remarkable anxiety and repetitive behaviors or ritualized acts, such as compulsions. Importantly, the symptoms of OCD are commonly accompanied by a sense of doubt, displeasure, and anxiety, which seriously affect an individual's social functioning (Roth et al., 2007).

In addition, it is widely recognized that pathological doubt (PD), a prominent feature of OCD, reflects difficulty in tolerating ambiguous or uncertain situations (Aardema & O'Connor, 2012;

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Gentes & Ruscio, 2011). Consequently, OCD patients exhibit a compromised capability in tolerating uncertainty by adopting an attentional coping style in the face of ego-threatening events (Gallagher, Susan, & Oltmanns, 2003; Tolin et al., 2001). Recent work on OCD has also demonstrated that patients who suffer from OCD tend to be uncertain regarding their specific cognitive functions, such as memory, decision-making and perceptions (van den Hout & Kindt, 2004; Hermans et al., 2008; Olley, Malhi, & Sachdev, 2007).

To investigate the complex mechanisms of OCD, a theoretical model referred to as ‘Seeking Proxies for Internal States’ (SPIS) has been established to formulate a general hypothesis regarding OCD (Lazarov, Dar, Oded, & Liberman, 2010). The developed SPIS model is based on previous models (Szechtman & Woody, 2004), which demonstrated the pervasive doubts and other related symptoms of OCD stem from deficient ‘subjective convictions’ or ‘feelings of knowing.’ Interestingly, the ‘feeling of knowing,’ which is defined as a subjective conviction functionally independent from the knowledge of objective reality (p. 115), is considered related to OCD (Szechtman & Woody, 2004). In particular, the internal states in the SPIS model are generally described as cognitive, affective, or bodily “subjective states that cannot be fully assessed by outside observers or objective measures” (p. 1402) (Lazarov, Dar, Liberman, & Oded, 2012b). Furthermore, the ‘proxies’ in the SPIS model are defined as indicators that substitute for the internal states that are more easily recognizable or less faint to detect, such as norms, regular behaviors, or environmental stimuli (Lazarov et al., 2010). More importantly, the hypothesis of the SPIS model indicates that obsessive-compulsive (OC) tendencies are associated with deficient subjective convictions regarding internal states, which may cause individuals with high OC tendencies to rely more on the self-perception processes in inferring their own internal states (Lazarov, Dar, Liberman, & Oded, 2012a). Similarly, the self-perception theory also states that individuals are apt to depend on their own behaviors, such as attitudes, personal characteristics and dispositions, to access their internal states when the internal cues are weak, ambiguous or uninterpretable (Bem, 1972).

To date, the SPIS theory is developing into a robust analysis tool used to characterize the features of OCD. Investigation into the SPIS theory paves a novel avenue for an improved understanding of the mechanism of OCD (Lazarov, Cohen, Liberman, & Dar, 2015; Lazarov et al., 2010, 2012a, 2012b). For example, Lazarov et al. (2012a) adopted false biofeedback as a proxy for internal states to examine the SPIS theory. However, the samples of participants from this work were not necessarily representative of individuals with OC tendencies because most of the participants were psychology students in college, and the proposed protocol of this work was insufficient to verify the SPIS theory.

To resolve this problem, a systematic investigation was performed using an adapted false bio-feedback task (Lazarov et al., 2012a) to assess the SPIS theory based on representative samples of participants. We initially revisited the definition of internal states that Lazarov et al. (2010) had initiated, and we subsequently adopted a muscle-tension paradigm to inspect the effects of undermined confidence on the internal states of the participants. Specifically, two well-designed studies were conducted to comprehensively and effectively examine the relationship between self-perception and OC tendencies in Study 1 and the link between self-perception and confidence in an individual’s internal states in Study 2.

2. Study 1

The aim of our first study is to examine the hypothesis that subjects with high OC (HOC) tendencies are more susceptible to

self-perception effects related to internal states compared with subjects with low OC (LOC) tendencies. In addition, tests are implemented to identify potential differences in the confidence regarding the targeted internal state between the HOC and LOC participants. Based on the research protocol described in the introduction section, it is reasonable to assume that compared with the LOC participants, the HOC participants will rely more on false bio-feedback to judge their own level of muscle tension. In addition, it is rational to expect that the false feedback has no influence on the actual muscle tension for both groups.

2.1. Methods

2.1.1. Participants

The first step of the present study comprised a screening process in which 340 college students at Southwest University in China completed the Padua Inventory (PI) (Sanavio, 1988). We subsequently sorted the scores of the 328 valid questionnaires from high to low. This sampling method should yield a more representative and diverse sample compared with previous studies, in which only psychology students were included (Lazarov et al., 2010, 2012a, 2012b; 2015). For the present work, the subjects with scores greater than 100 were considered HOC participants, whereas the LOC participants were defined by scores less than 20 (Fullana et al., 2004).

After the initial screening, the generated sample included 13 (9 female) HOC participants and 17 (14 female) LOC participants. There was no significant difference ($t(28) = 0.49, p = 0.63$, Cohen’s $d = 0.18$) between the two groups regarding age (HOC: 21.00 ± 1.63 ; LOC: 21.35 ± 1.6). All participants had normal or corrected-to-normal vision. Participants with reported histories of neurological or psychiatric disorders, brain damage, or the use of psychotropic drugs were excluded from this study. No participants had previous experience with bio-feedback. All participants volunteered to participate in the study, signed an informed consent form, and were informed that they would receive a small gift following the experiment. All clinical tests were approved by the Ethics Committees of the University of Macau (Macao SAR, China) and Southwest University in China (Chongqing, China).

2.1.2. Apparatus

The muscle electrical activity was measured using NeXus-10 Mark II hardware and V2011 BioTrace + software (Mind Media B.V., Herten, Netherlands). Each participant was required to write down his(her) subjective judgment of the muscle tension and the confidence in his(her) judgment; thus, the measurements were performed on the flexor carpiulnaris muscle of the participant’s non-dominant arm using three separate electrodes placed on the skin. The electrodes recorded the EMG signals, which were subsequently sent to a laptop computer via a bio-feedback encoder and were ultimately displayed on the computer screen. An upward line indicated increased muscle tension, whereas a downward line denoted decreased muscle tension.

2.1.3. Measures

2.1.3.1. Obsessive-compulsive tendencies. OC tendencies were measured using the PI (Sanavio, 1988). The PI consists of 60 items rated on a 5-point Likert scale that ranged from 0 (none) to 4 (extreme). The present study used the Chinese-version of the PI. The Cronbach’s alpha for the PI was 0.93, which was close to the alpha value in previous work (Wakabayashi & Aobayashi, 2007). In addition, there was a significant difference in the PI scores ($t(28) = 25.66, p < 0.001$, Cohen’s $d = 8.80$) between the groups (HOC: 107.85 ± 14.83 ; LOC: 13.85 ± 2.83).

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